AC:

BASIC POWER SUPPLIES

Unclassified

Safety & Environmental Impact is "LOW"

AC: Power Supplies

Terminal Learning Objective

ACTION:

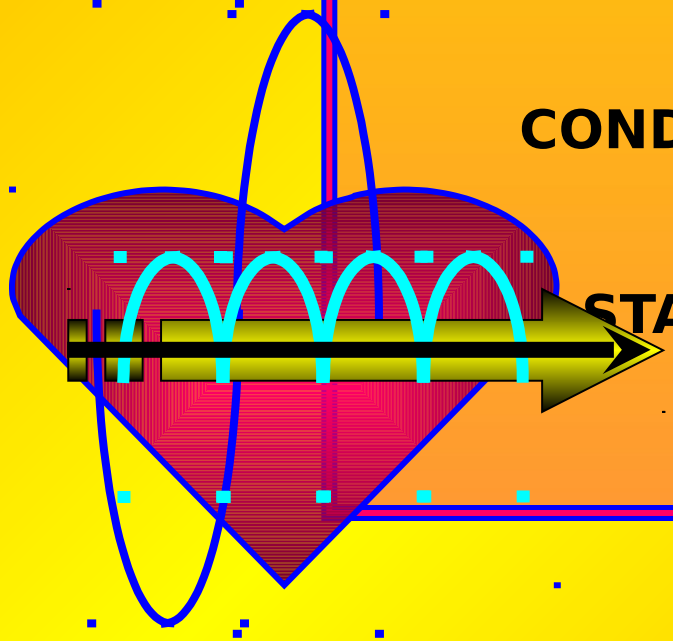
Identify Symptoms of a malfunction & Characteristics of a Basic Power Supply Given, Ckt Cards & Schematic.

CONDITIONS:

With out references.

STANDARD:

A minimum of 7 correct answers from 10 questions.

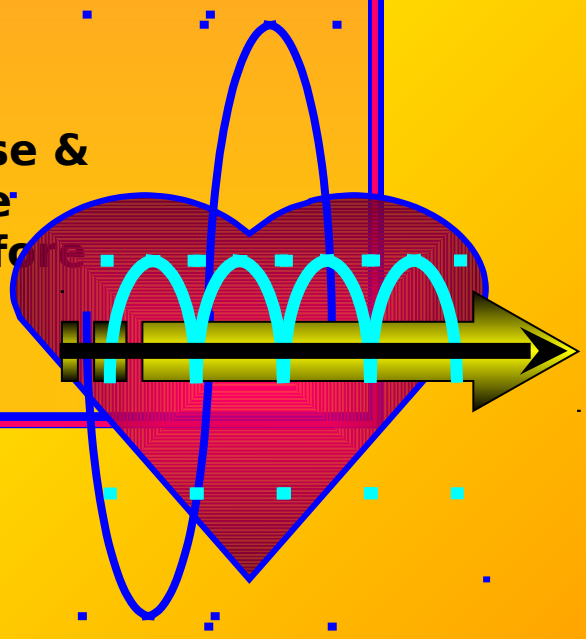


AC: Power Supplies

Introduction

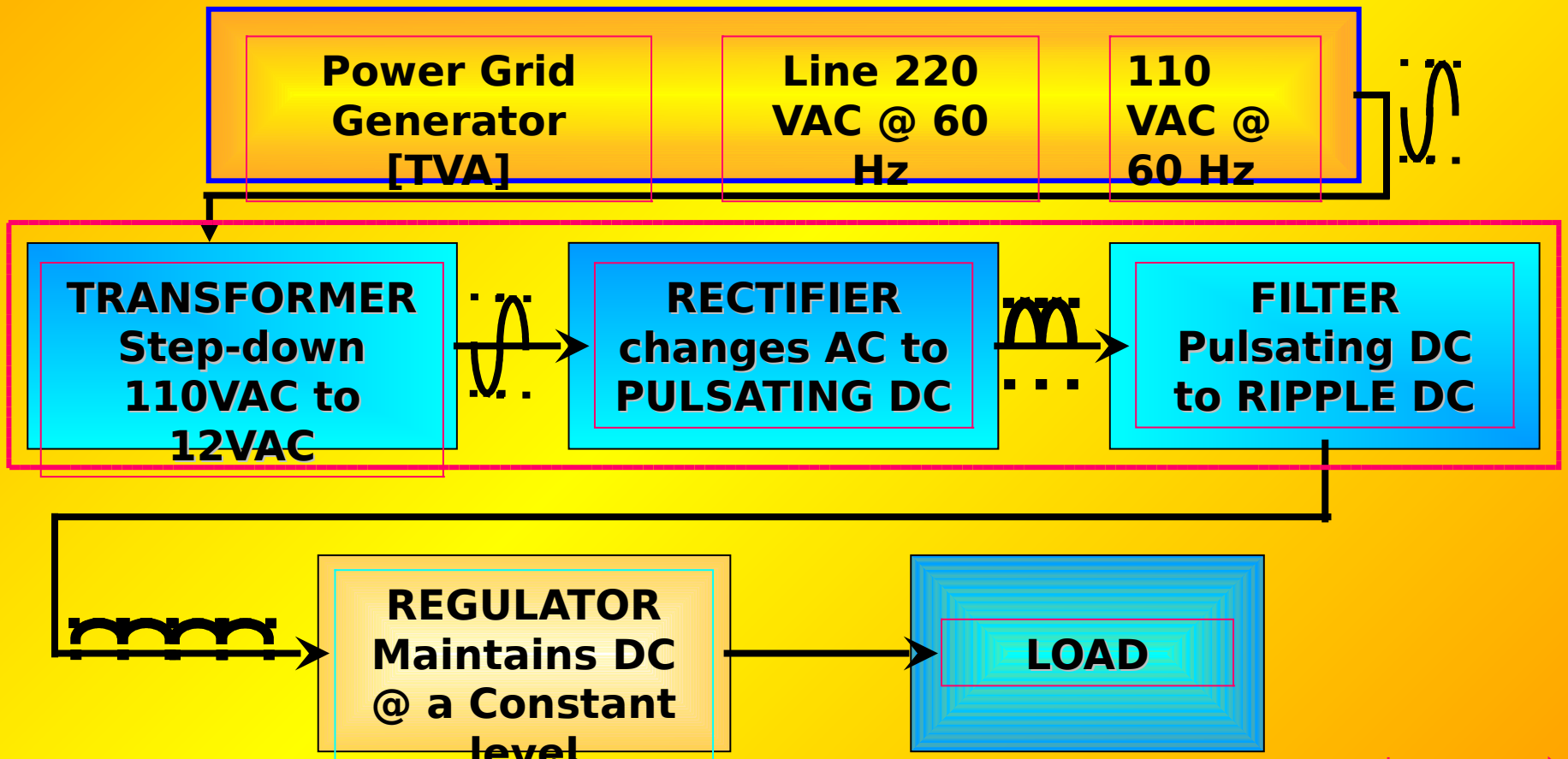
In every major Defense System there is a source for providing power and distributing it through a system.

Therefore the power supply can easily be thought of as the heart of a system. It will be one of the first checks made in Maintenance. It makes good sense & good maintenance procedure to to ensure that the voltages applied are correct before looking elsewhere for a malfunction.



AC: Power Supplies; Overview

Block Diagram:

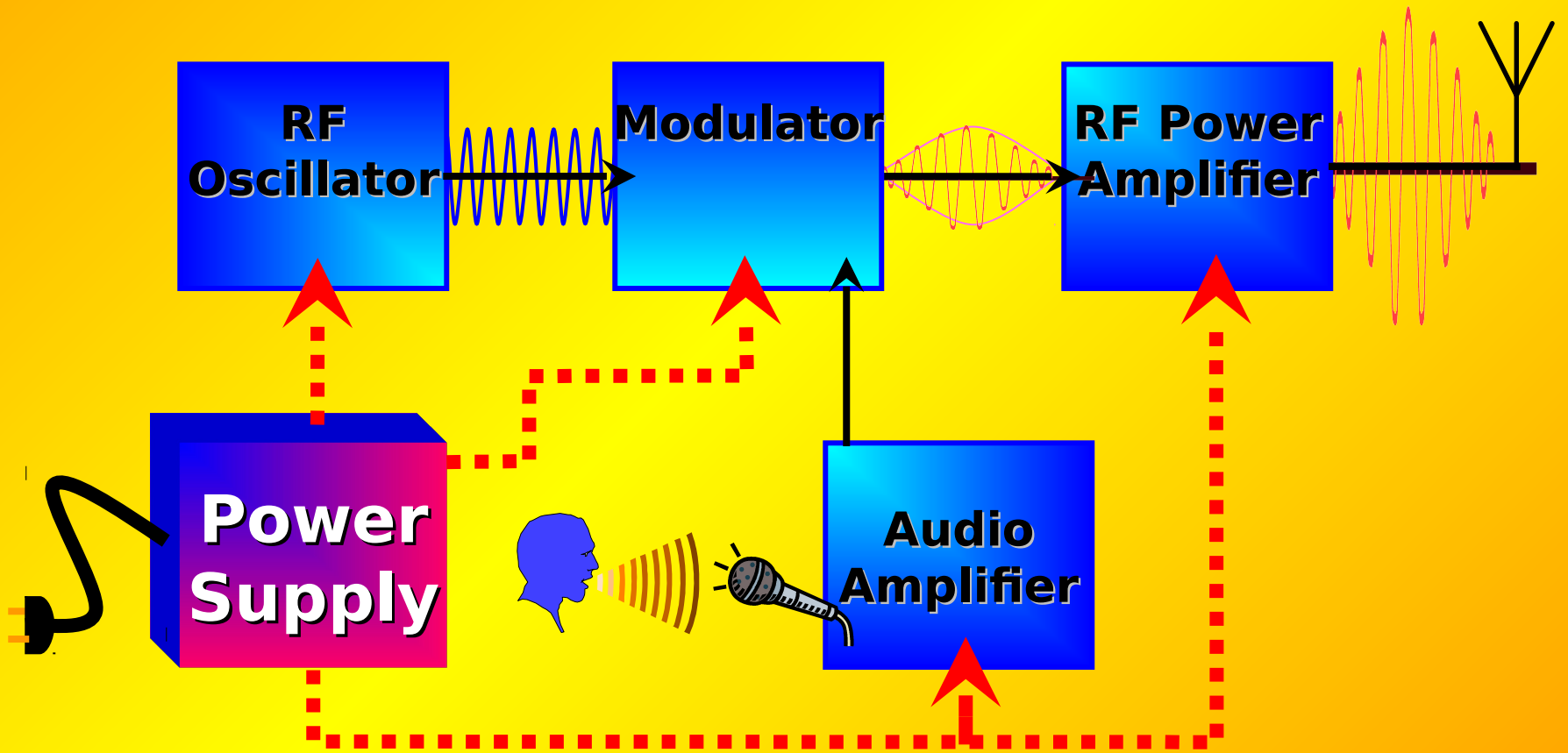


Covered in TII

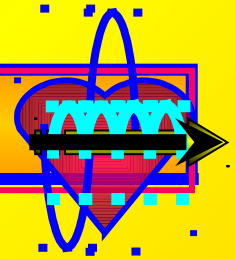
Typical Use

AC: Power Supplies; Overview

Block Diagram: Radio Transmitter Group, A typical use.



AC: Power Supplies; Overview



Terms:

Power Supply;

Changes the AC Line Voltage to the required DC operating Voltages for the designated equipment. It can be + or – or both.

Rectifier;

Changes the AC output of the Transformer to "PULSATING DC".

+ or - Half wave

+ or - Full wave

Allows Current to flow in 1 direction, It acts like a one way valve, or one way Current device.

Diode

AC: Power Supplies; Diodes

Semiconductor Diode: The most common device for Rectifier Ckts.

Diode;

Sometimes referred to as a Crystal.

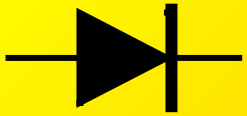
<u>Advantages</u>; Small in size, Low Voltage ops, Uses less power.

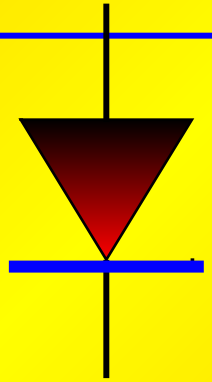
<u>Disadvantages</u>; Sensitive to Heat & High Voltage.

Letter Symbol;

CR or **D**, **CR_1, $_2$, $_3$, ...**

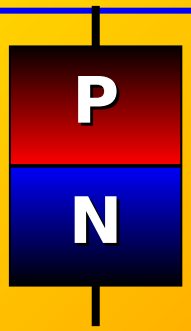
Schematic Symbol;





Positive Material, ANODE

Negative Material, CATHODE



Bias

AC: Power Supplies; Diodes

BIAS: 2 states of operation, Forward & Reverse Bias

Bias;

Is the Difference of Potential between 2 points or Elements.

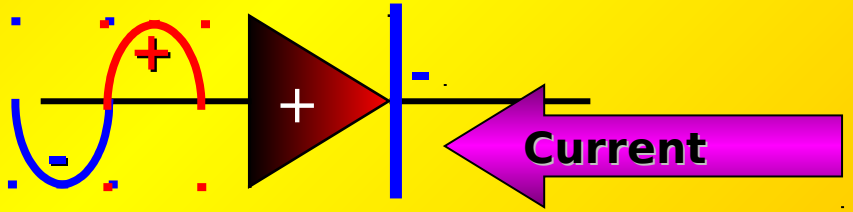
Forward Bias;

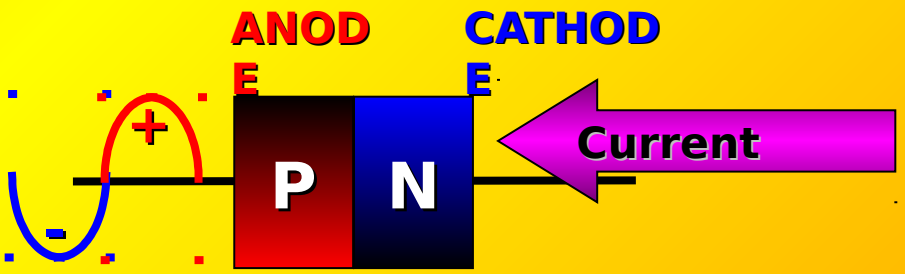
When the Polarity of the Signal agrees w/ the Polarity of the material.

Current flow is Maximum.

Resistance is Minimum.

Current Flows against the Arrowhead, (Anode)





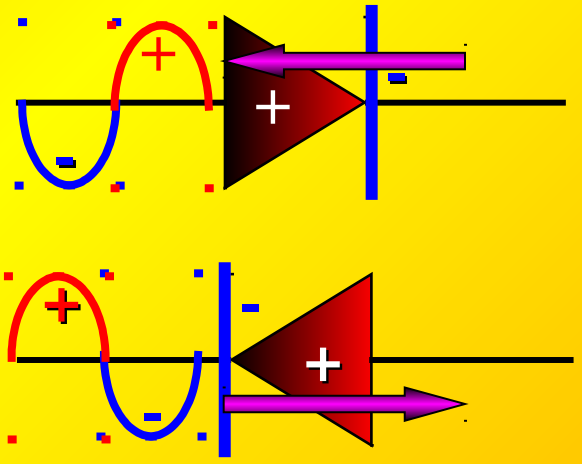
Reverse Bias

AC: Power Supplies; Diodes

BIAS: 2 states of operation, Forward & Reverse Bias

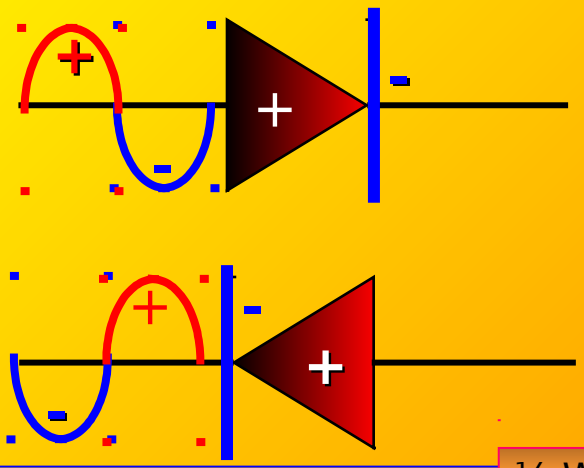
Forward Bias;

When the Polarity of the Signal "agrees" w/ the Polarity of the material, Current flow is Maximum, Resistance is Minimum.



Reverse Bias;

When the Polarity of the Signal "Disagrees" w/ the Polarity of the material, Current flow is Minimum, Resistance is Maximum.



AC: Power Supplies; ½ Rectifier

2 Types of ½ Wave Rectifiers: Positive & Negative

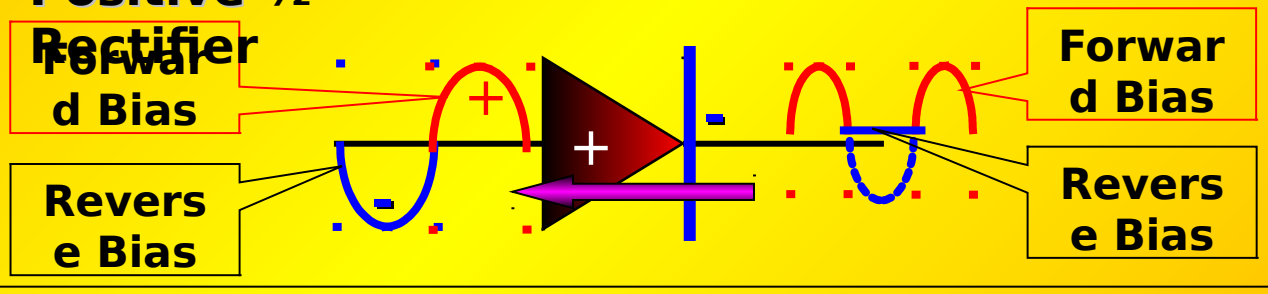
½ Wave Rectifier;

The position of the Diode in respect to the input will determine the polarity of the output.

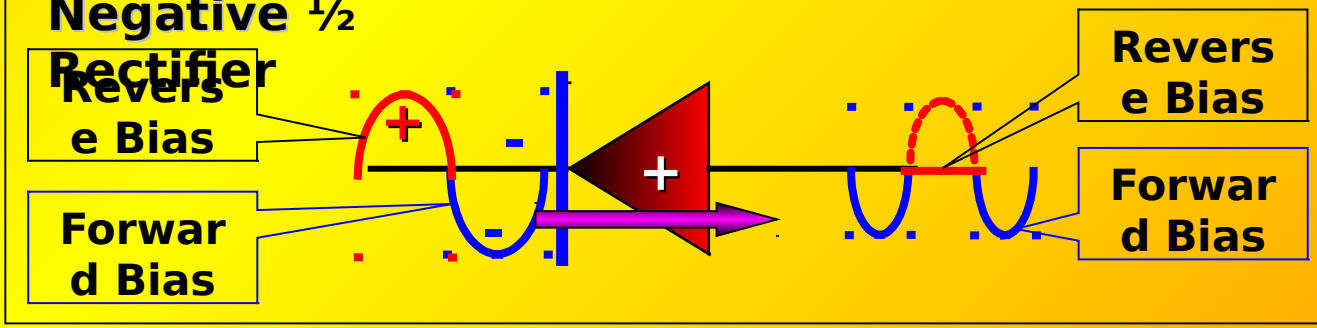
1 diode makes it a ½ wave Rectifier.

Frequency in = Frequency out.

Positive ½ Rectifier



Negative ½ Rectifier

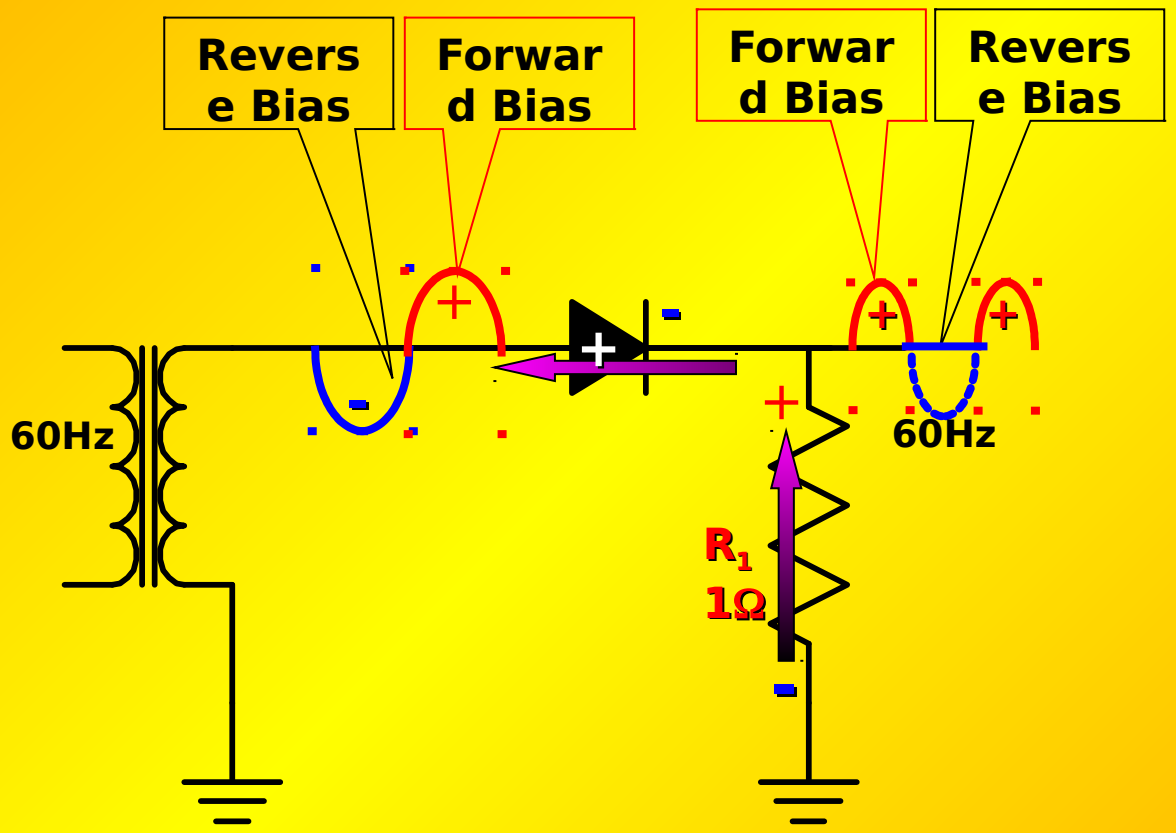


+½ Wave Rec

AC: Power Supplies; ½ Rectifier

Positive ½ Wave Rectifier:

Increasing forward bias increases current flow through a fixed value of resistance, thus an increasing voltage drop is developed at the output.



4 X 1 = 4v
3 X 1 = 3v
2 X 1 = 2v
1 X 1 = 1v
I X R = ER

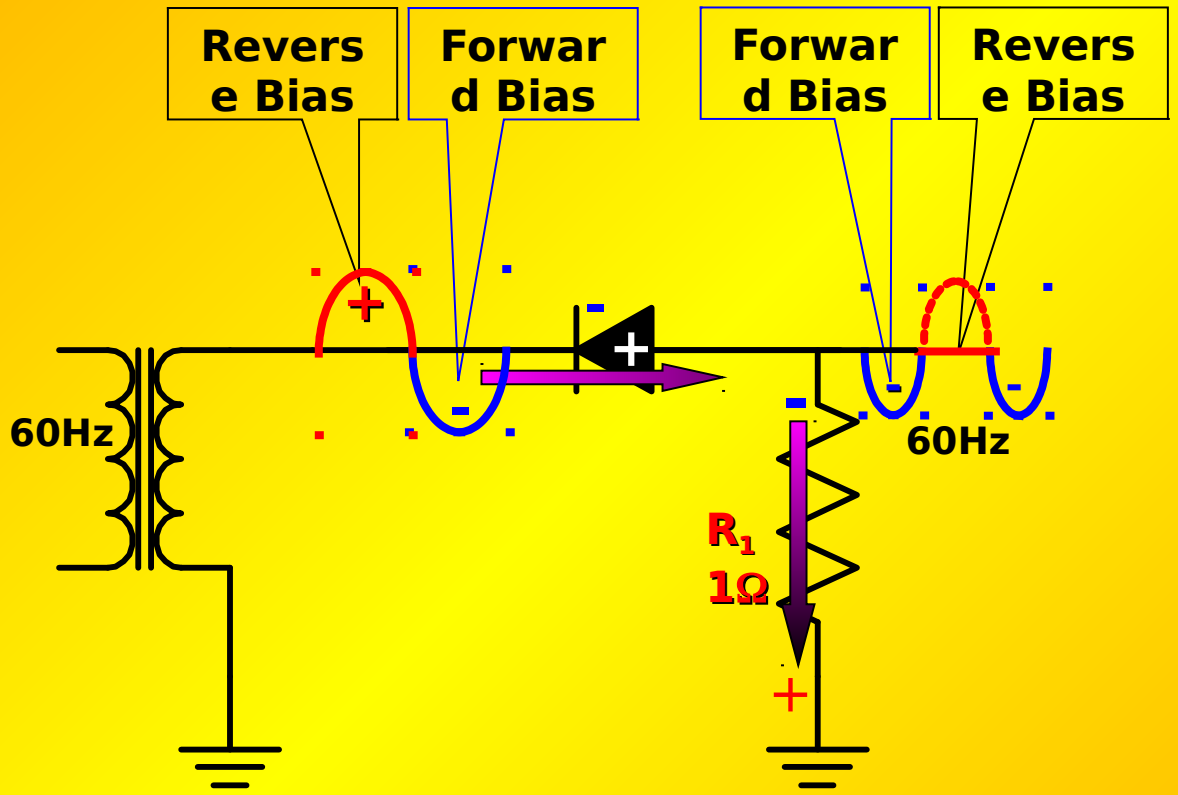
The out put signal is developed across the load resistor as current increases due to the increasing + polarity of the signal.

-½ Wave Rec

AC: Power Supplies; ½ Rectifier

Negative ½ Wave Rectifier:

Increasing Forward Bias Increases Current flow through a fixed value of resistance, thus an increasing voltage drop is developed at the output.



4 X 1 = -4v

3 X 1 = -3v

2 X 1 = -2v

1 X 1 = -1v

I X R = -ER

The out put signal is developed across the load resistor as current increases due to the increasing + polarity of the signal @ Gnd.

+ Full Wave Rec

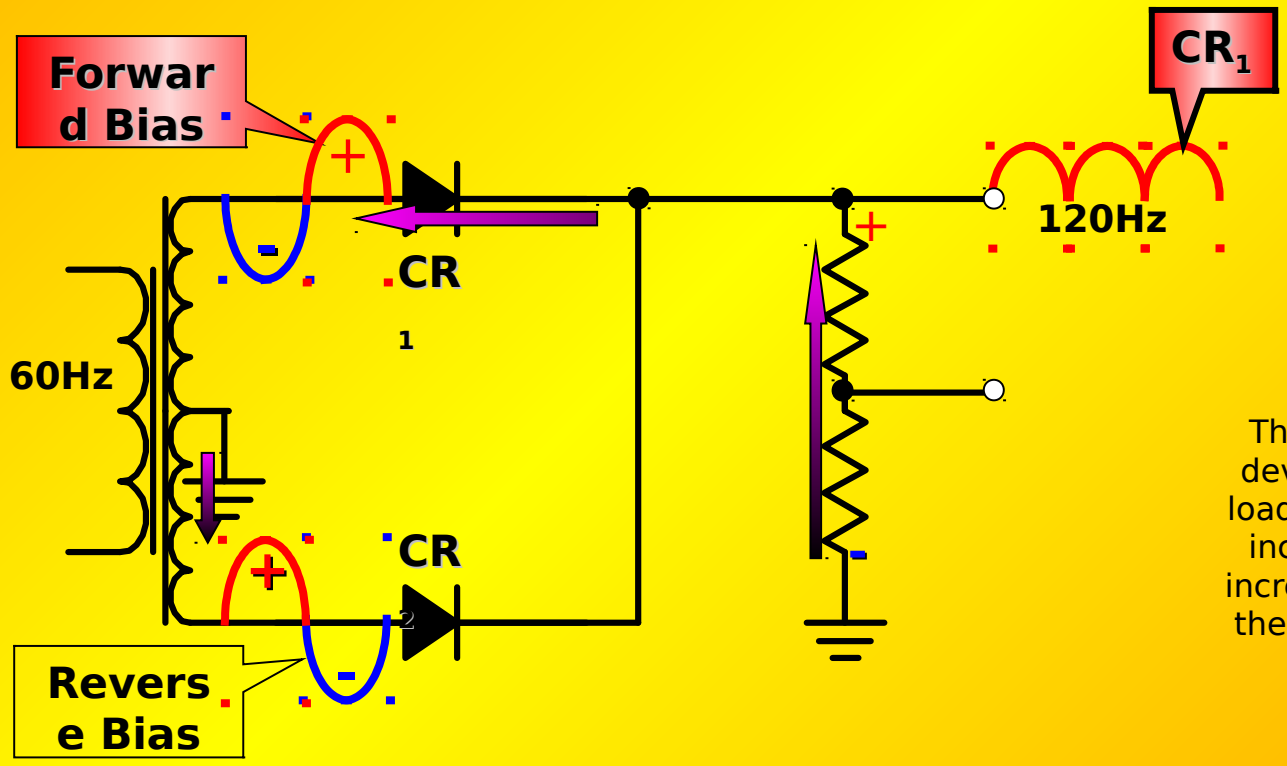
AC: Power Supplies; Rectifier

Positive Fullwave Rectifier: CR1 conducts.

The Fullwave Rectifier is identified by two Diodes.

The position of the Diode in reference to the direction of the input signal determines the output polarity.

Only one Diode conducts at a time, Output freq is twice the input.

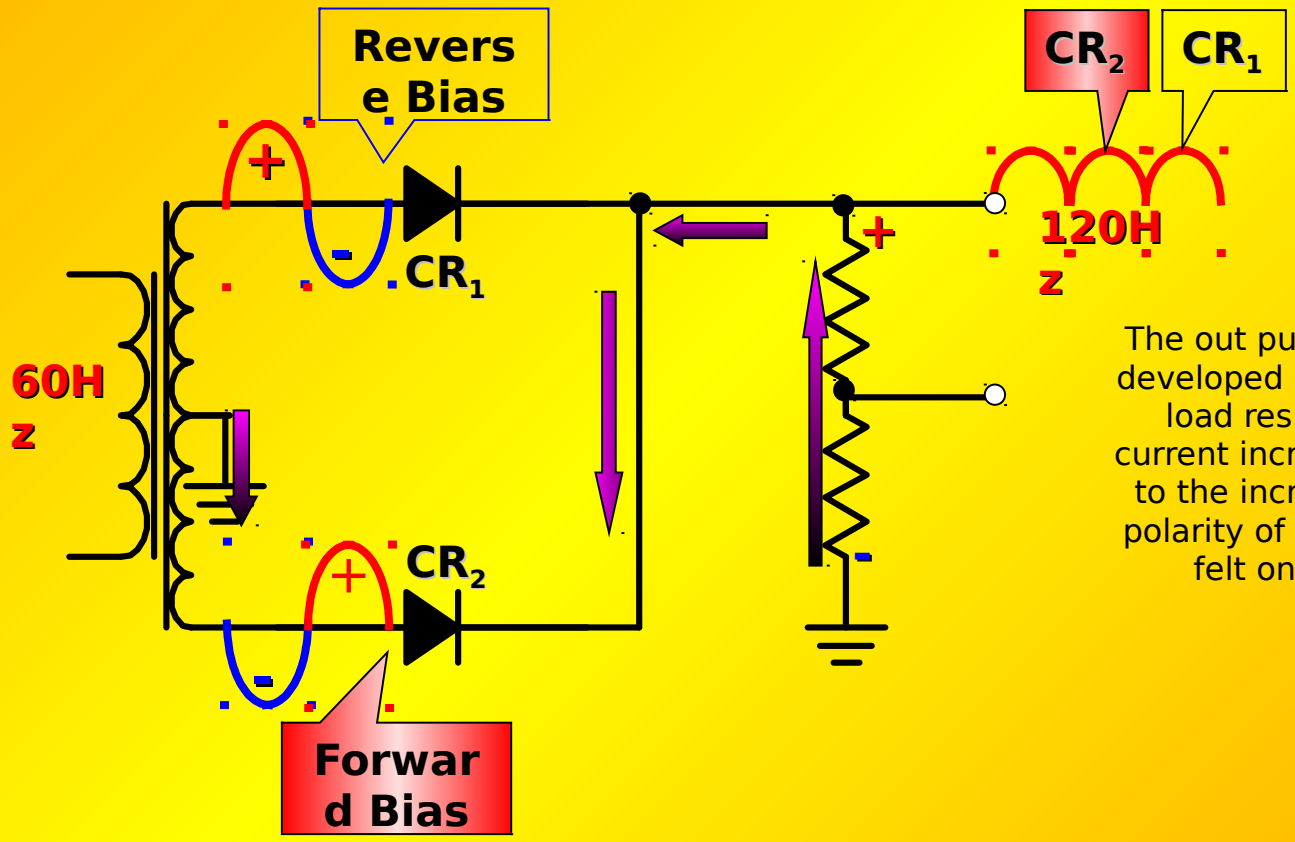


The out put signal is developed across the load resistor as current increases due to the increasing + polarity of the signal felt on CR1.

+ Full CR2 Bias

AC: Power Supplies; Rectifier

Positive Fullwave Rectifier: CR2 conducts.



The out put signal is developed across the load resistor as current increases due to the increasing + polarity of the signal felt on CR2.

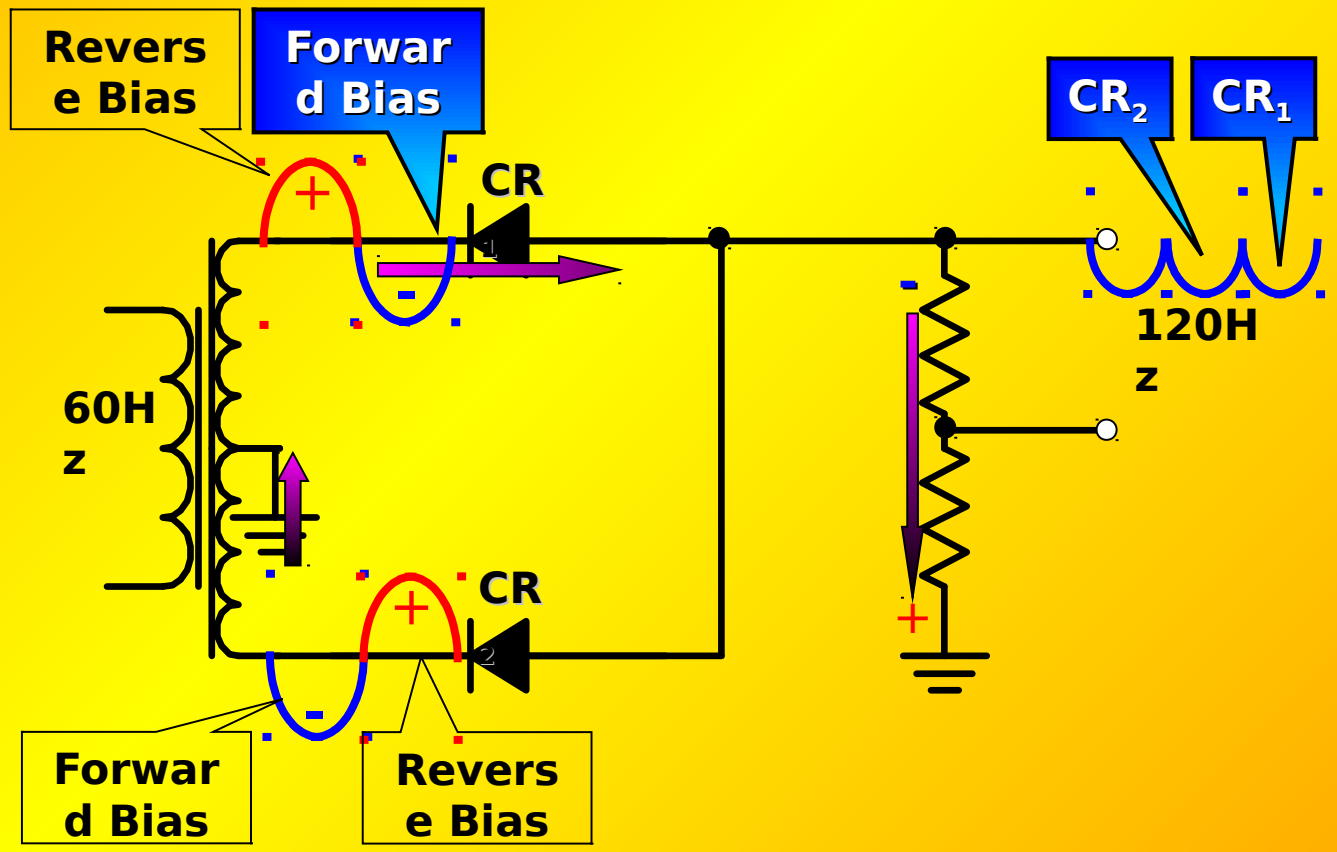
- Full Wave Rec

AC: Power Supplies; Rectifier

Negative Full Wave Rectifier:

The Negative Fullwave Rectifier Diode position in ref to direction of the input signal determines the output polarity.

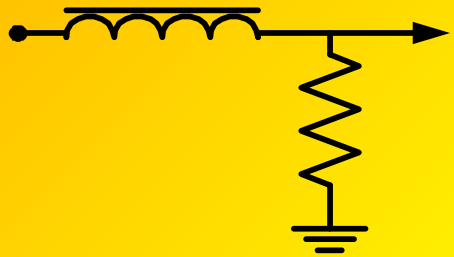
One diode conducts at a time. The output freq is twice the input.



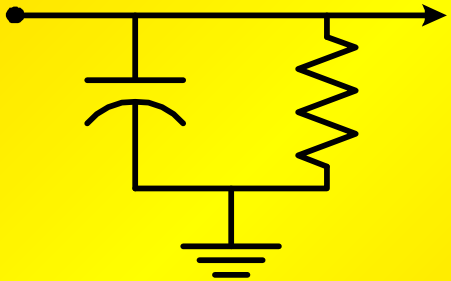
AC: Power Supplies; Filters

Filters types:

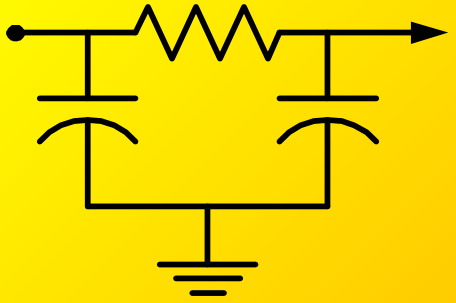
The Filter converts pulsating DC from the rectifier to Ripple DC & raises the DC voltage level.



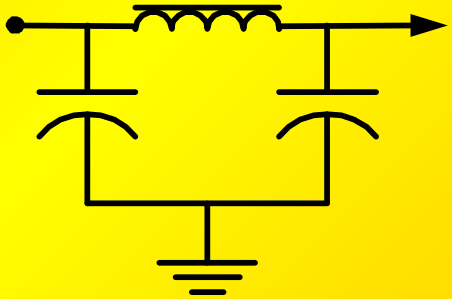
1. LR Inductive input



2. RC Filter



3. **RC pi Filter**



4. LC pi Filter

RC Filter

AC: Power Supplies; Filters

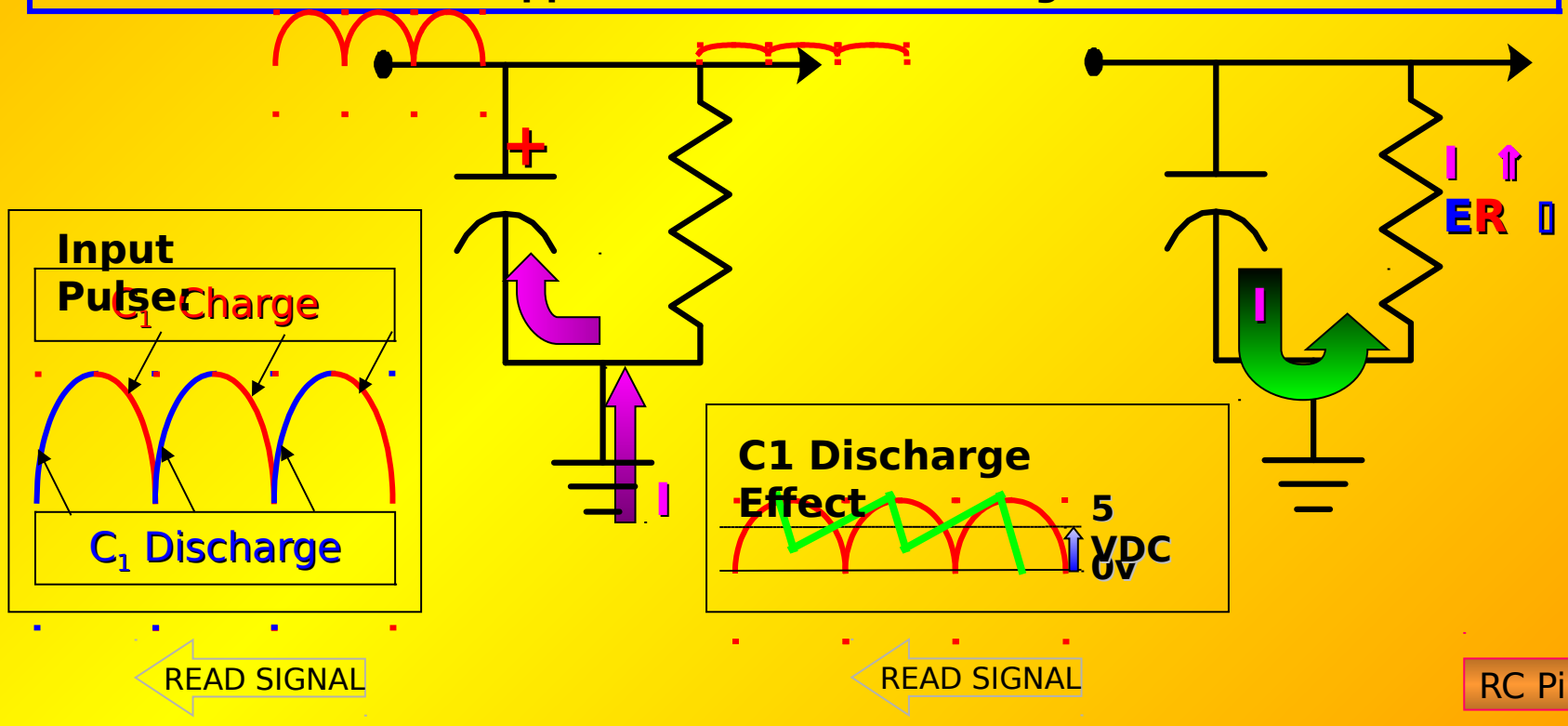
Filters RC: Most common type of filter, inexpensive.

RC Filter;

Quick charge cap, no opposition to current in the path of charge.

Slow discharge, through the resistor. Effectively fills the gap between the pulses. [fills in the speed bumps].

Reduces ripple & raises the DC Voltage level



RC Pi Filter

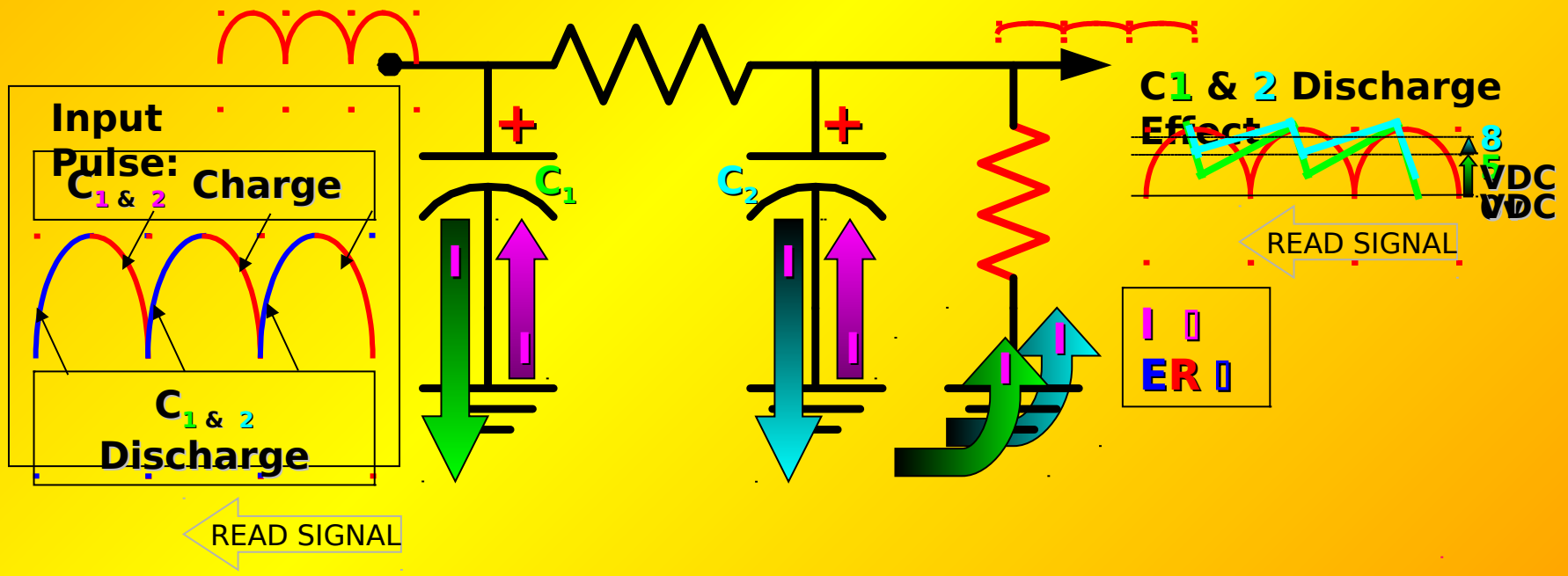
AC: Power Supplies; Filters

Filter, RC Pi : Better version of the RC type

RC Pi Filter;

Quick charge Cap, Slow discharge, through the resistor.
Effectively fills the gap between the pulses. [fills in the speed bumps].

2 Caps raise the DC Level & Reduces the Ripple even better than One.



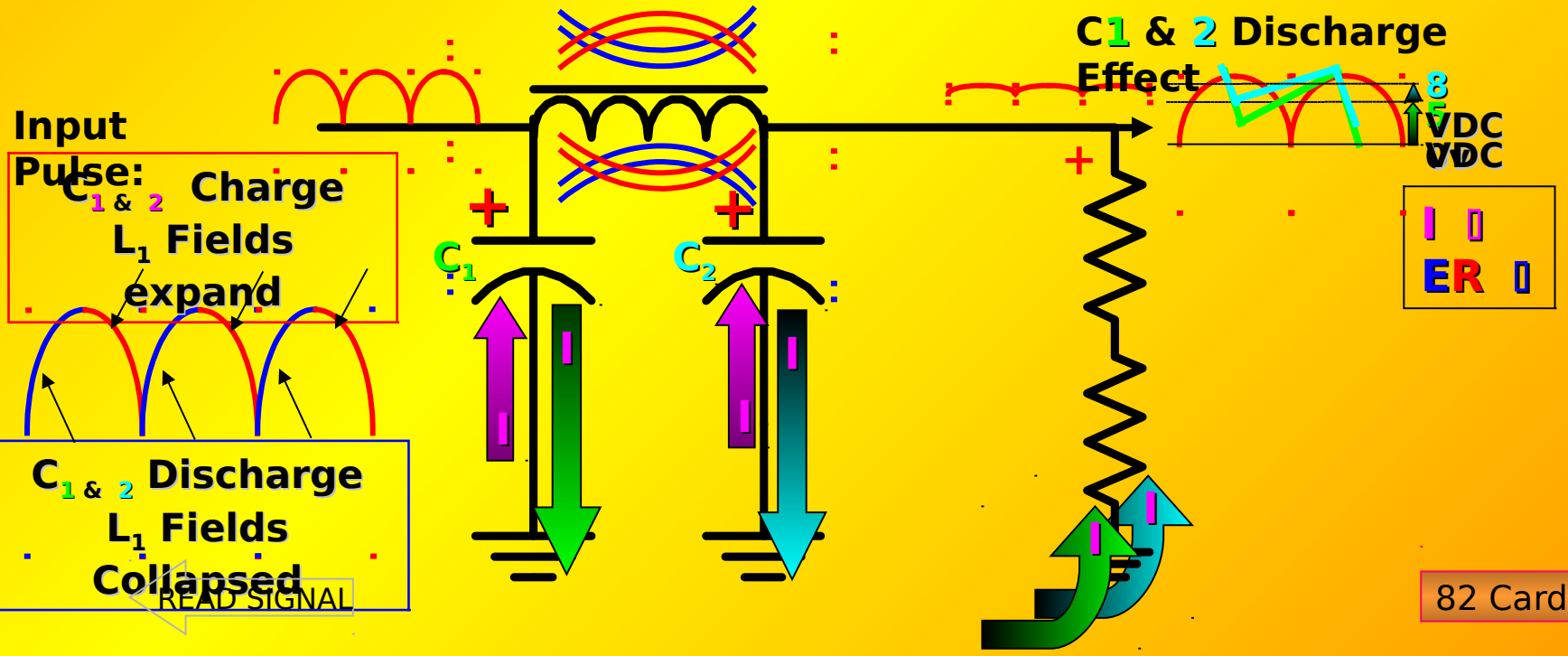
LC PI

AC: Power Supplies; Filters

Filter, LC Pi : Best Filter

LC Pi Filter;

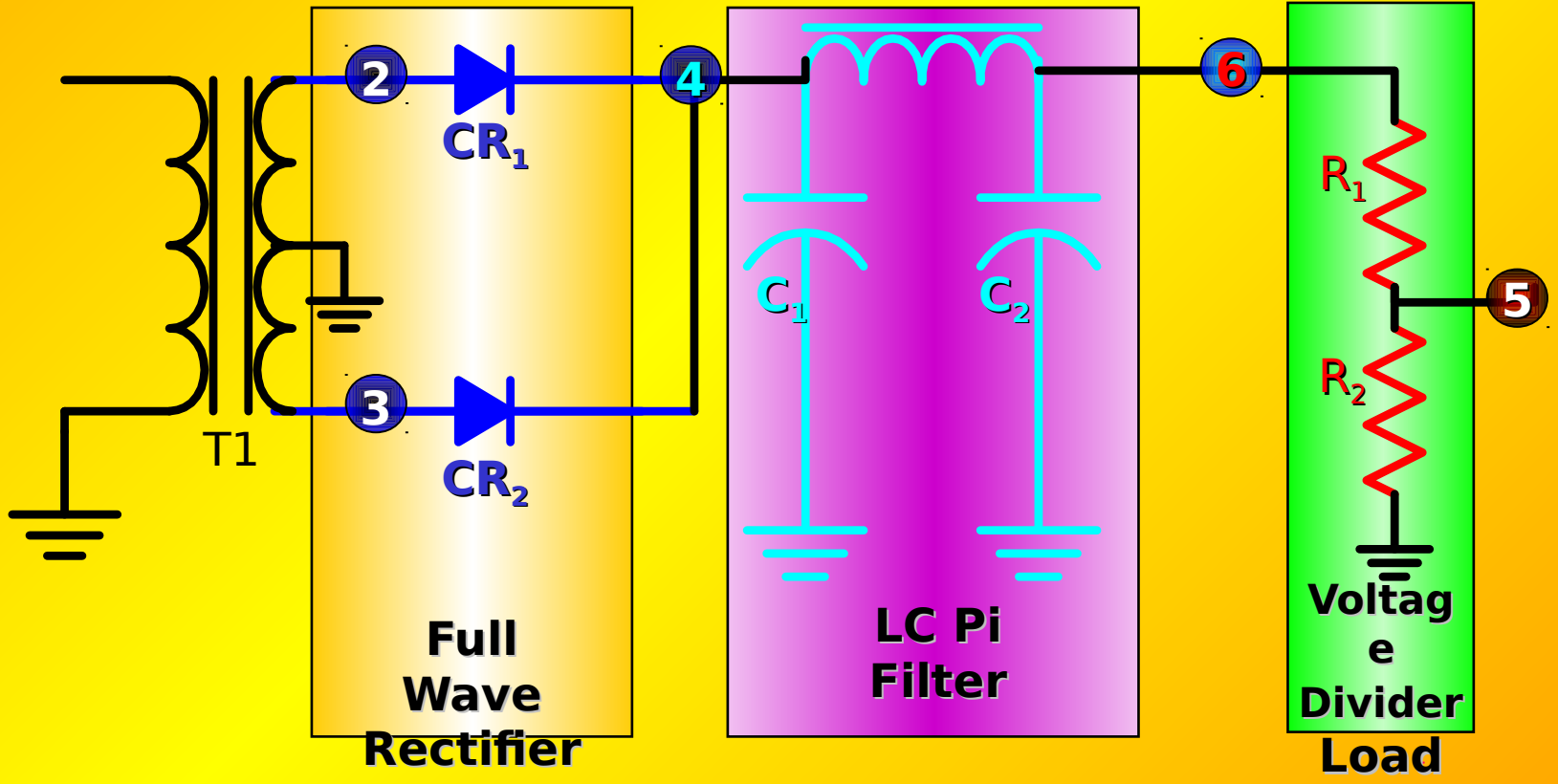
C_1 & $_2$ Quick charge cap, Slow discharge, through the resistor. L1 is acts like a choke, keeping current from fluctuating. The new DC applied is now established.



82 Card

AC: Power Supplies; PC-82

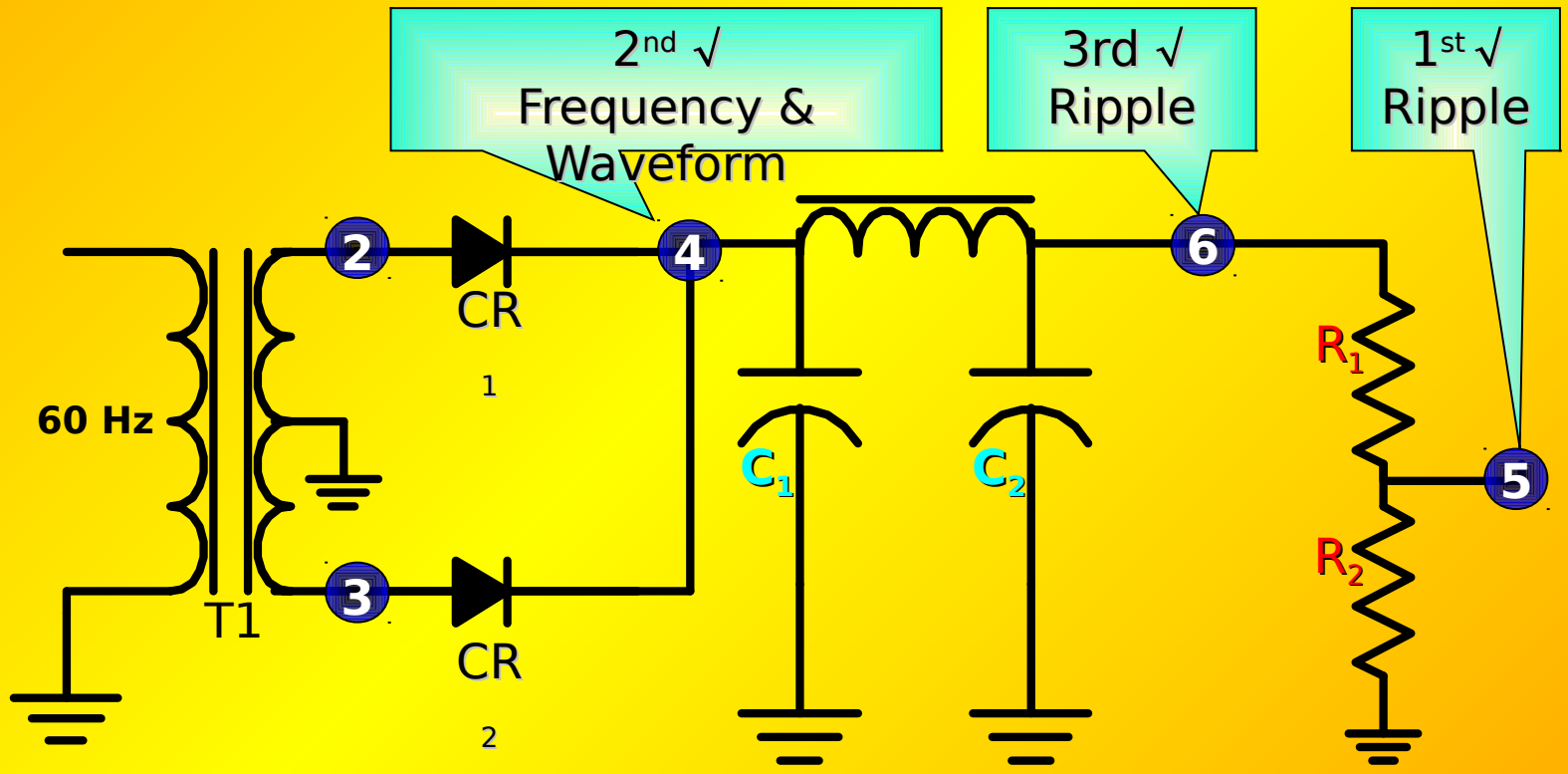
Circuits : Divide the Power Supply into its individual Ckts.



TP Sequence

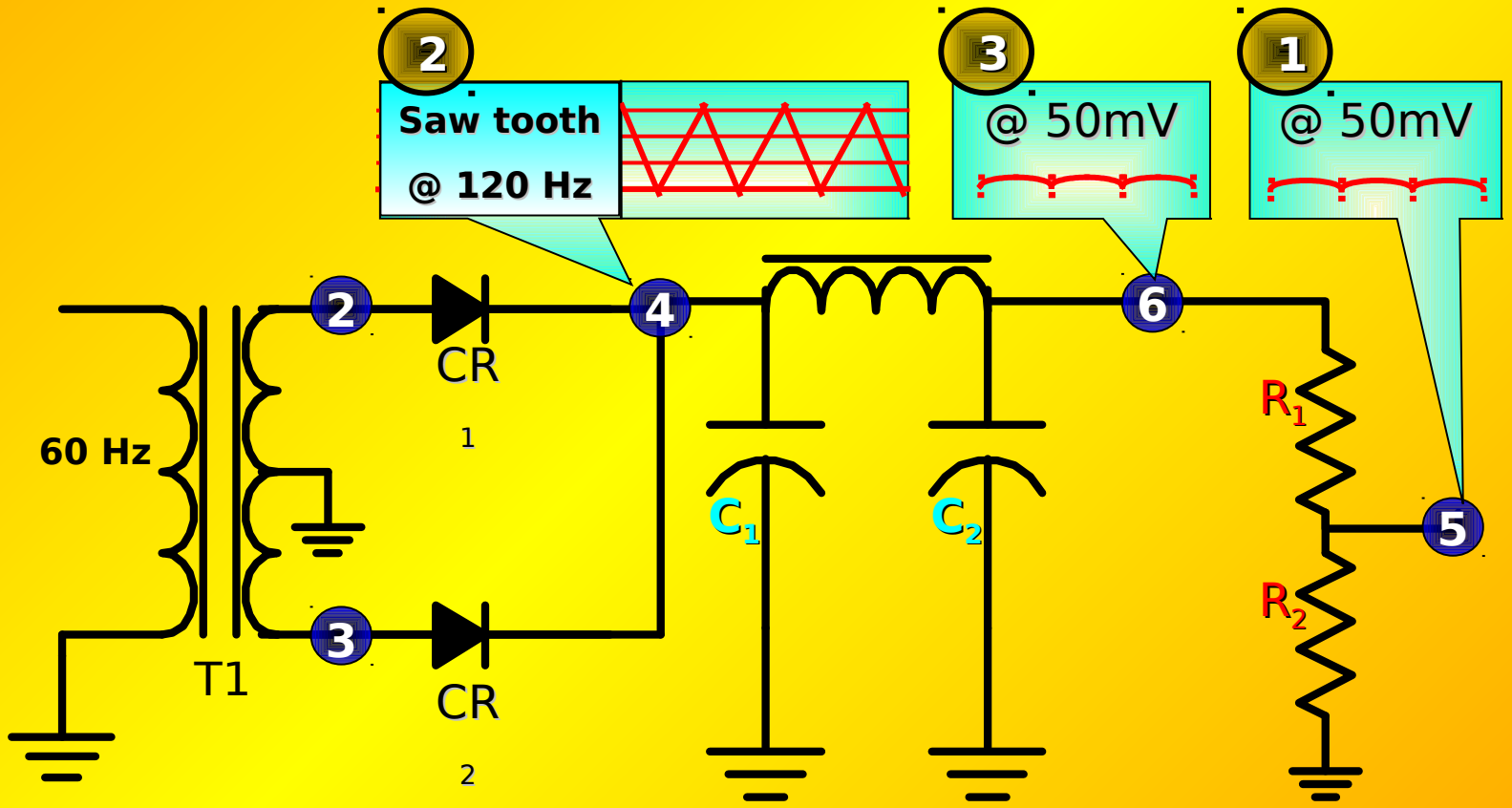
AC: Power Supplies; PC-82

½ Split Method : Test Point Check sequence.



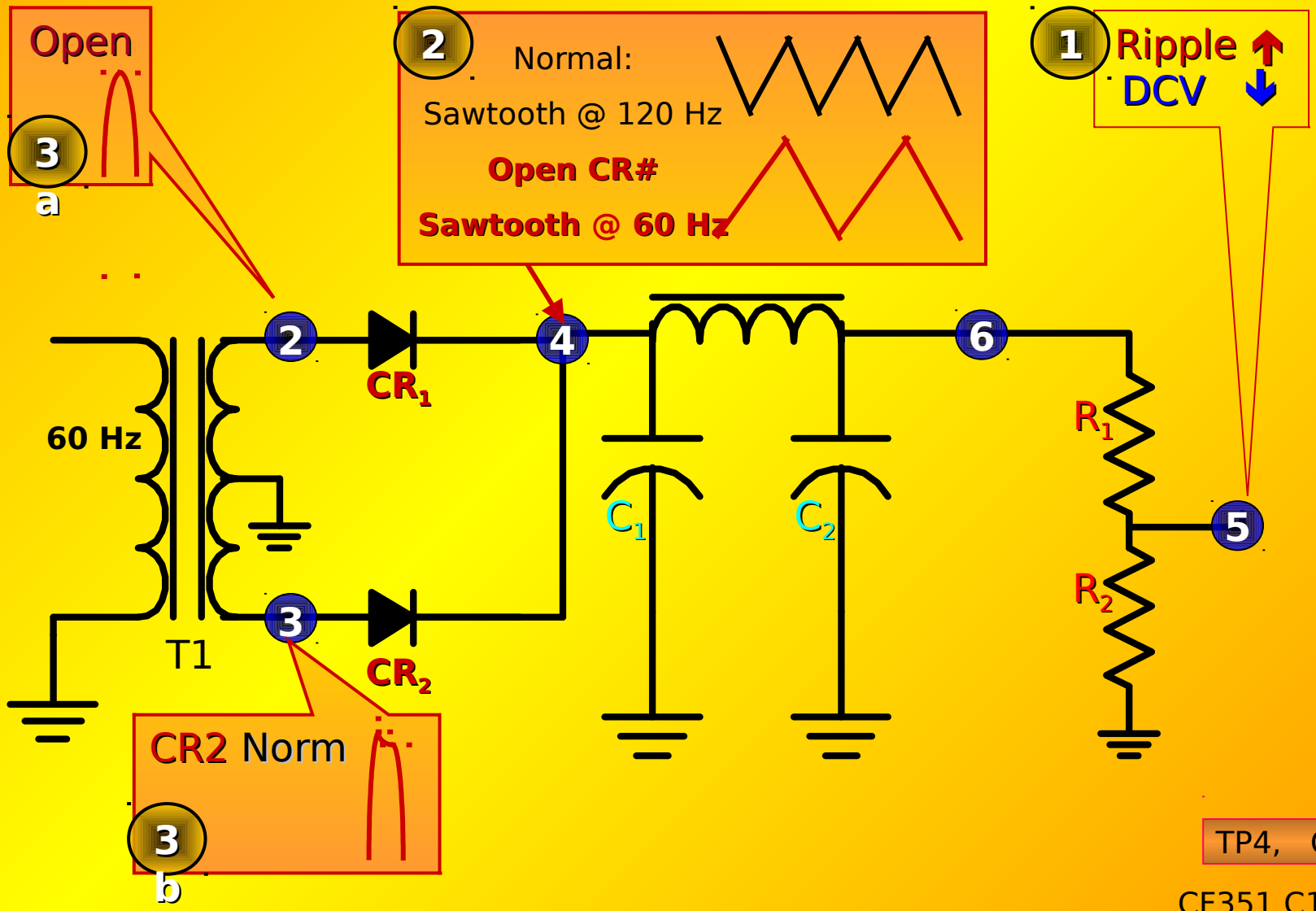
AC: Power Supplies; PC-82

½ Split Method : Normal Signals.



AC: Power Supplies; PC-82

½ Split Method : TP4 Signal Analysis, CR_1 OPEN .



TP4, C1

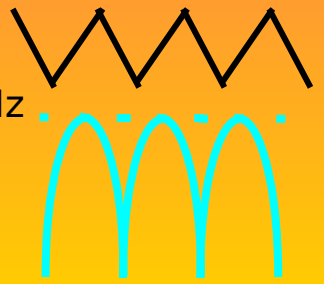
AC: Power Supplies; PC-82

½ Split Method : TP4 Signal Analysis, C_1 OPEN .

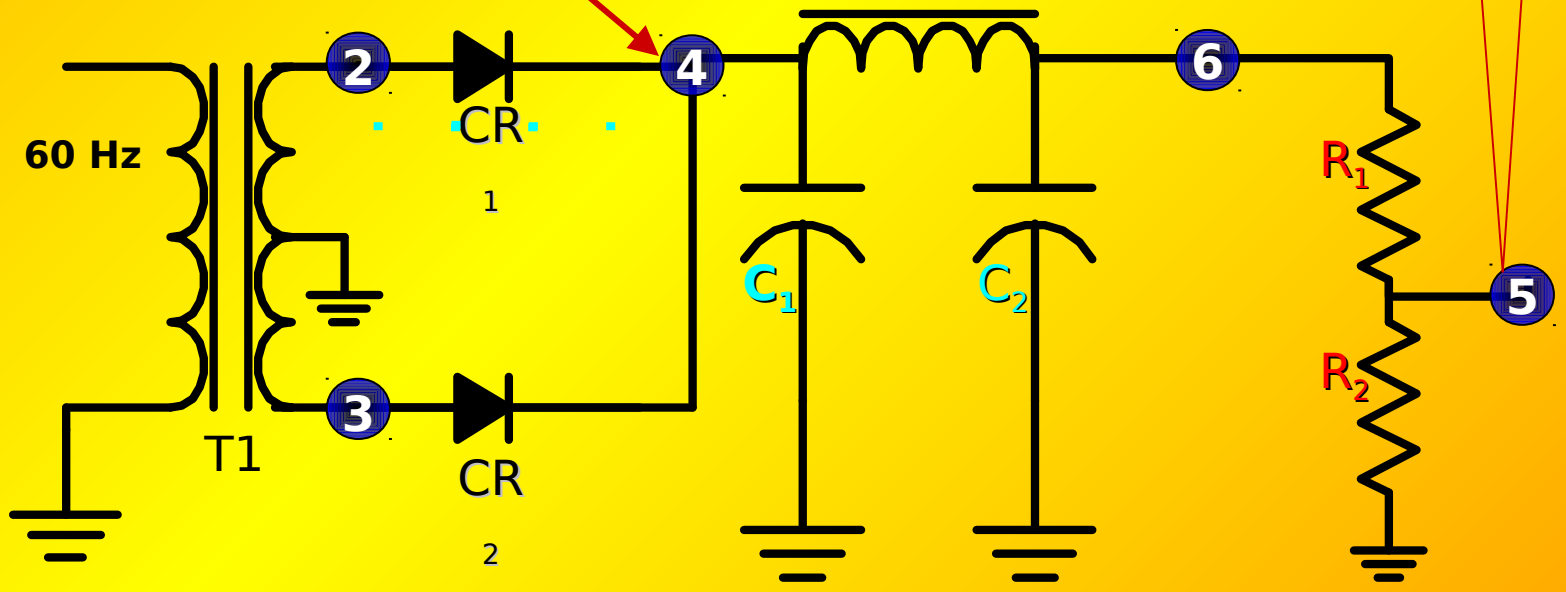
2 Normal:

Saw tooth @ 120 Hz

Open C1



1 Ripple ↑
DCV ↓



TP6 Analysis

AC: Power Supplies; PC-82

½ Split Method : TP6 Signal Analysis, C_2 OPEN .

2

Normal:

Saw tooth @ 120 Hz

No Problem @ **Tp4 Move on** to TP6

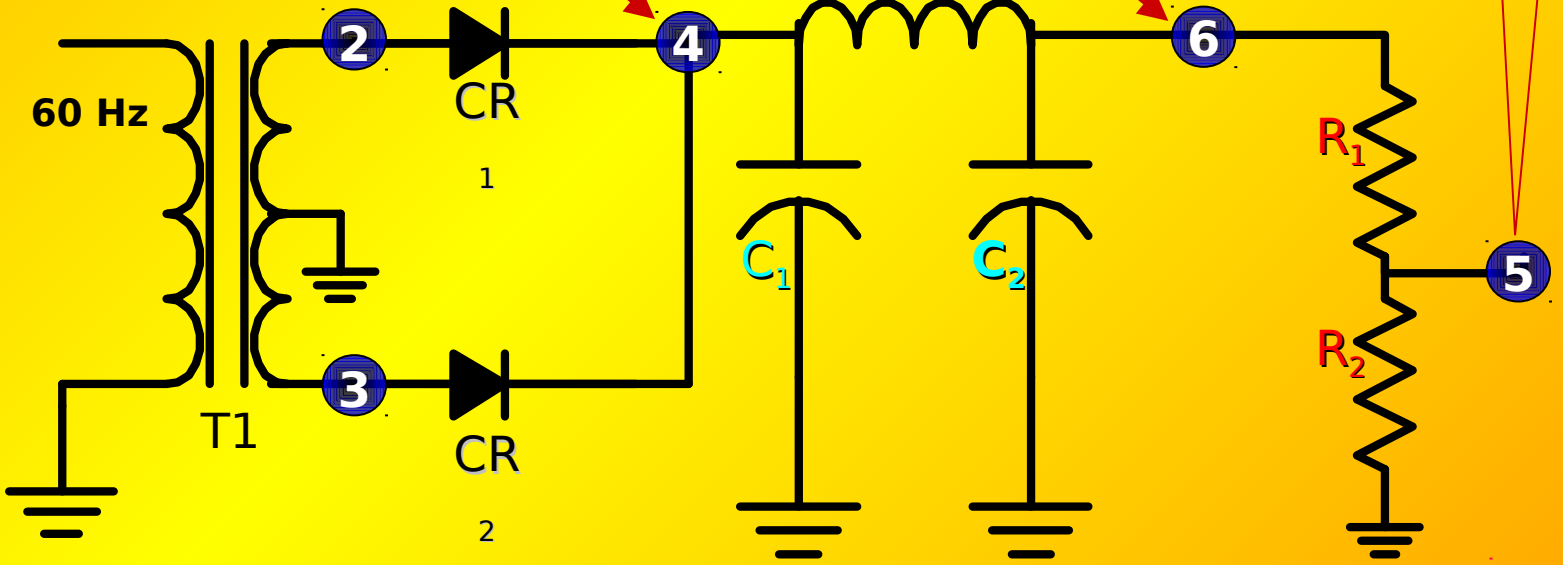
3

Normal

Sympto

1

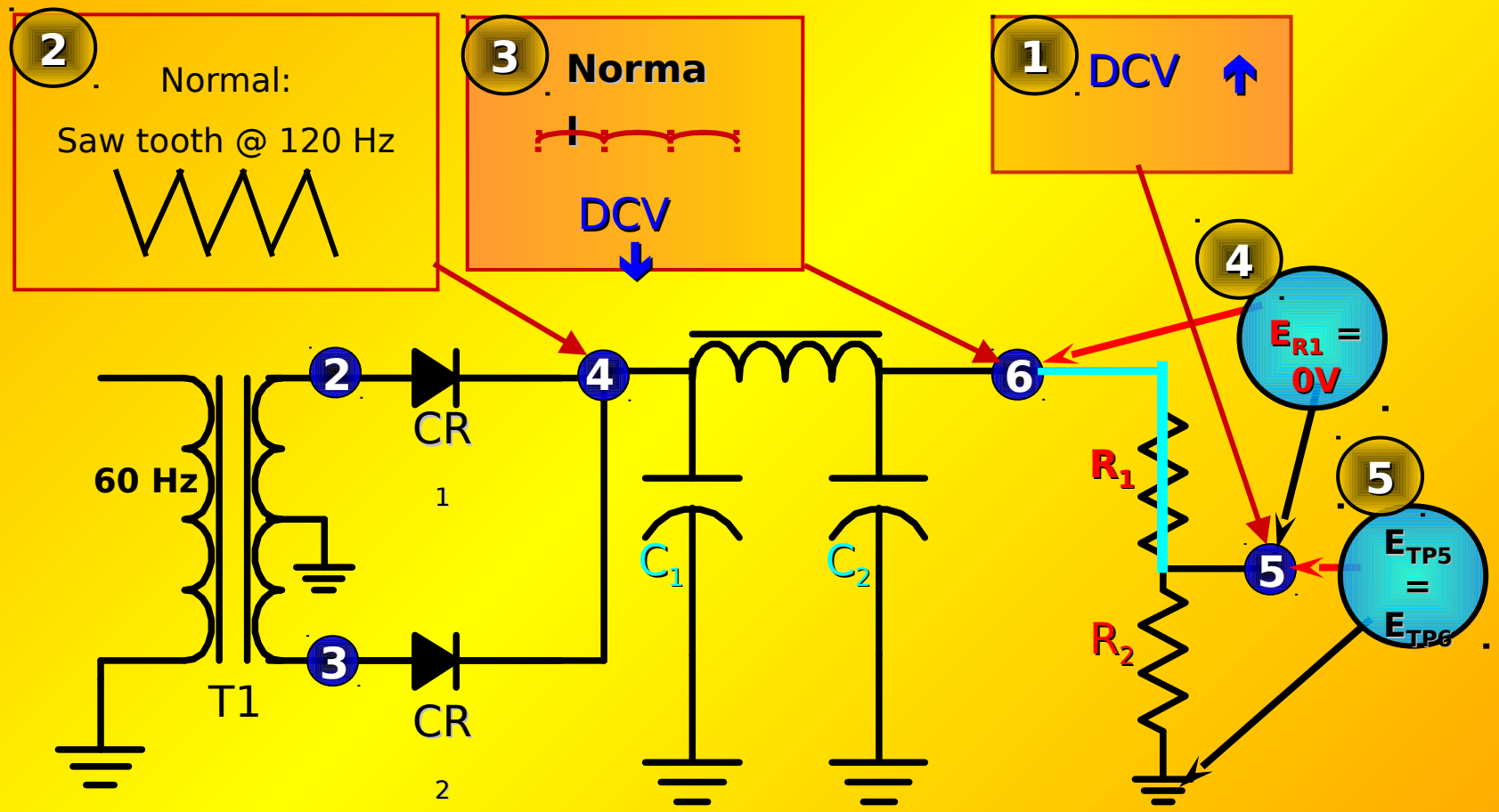
Ripple ↑
DCV ↓



R1 Analysis

AC: Power Supplies; PC-82

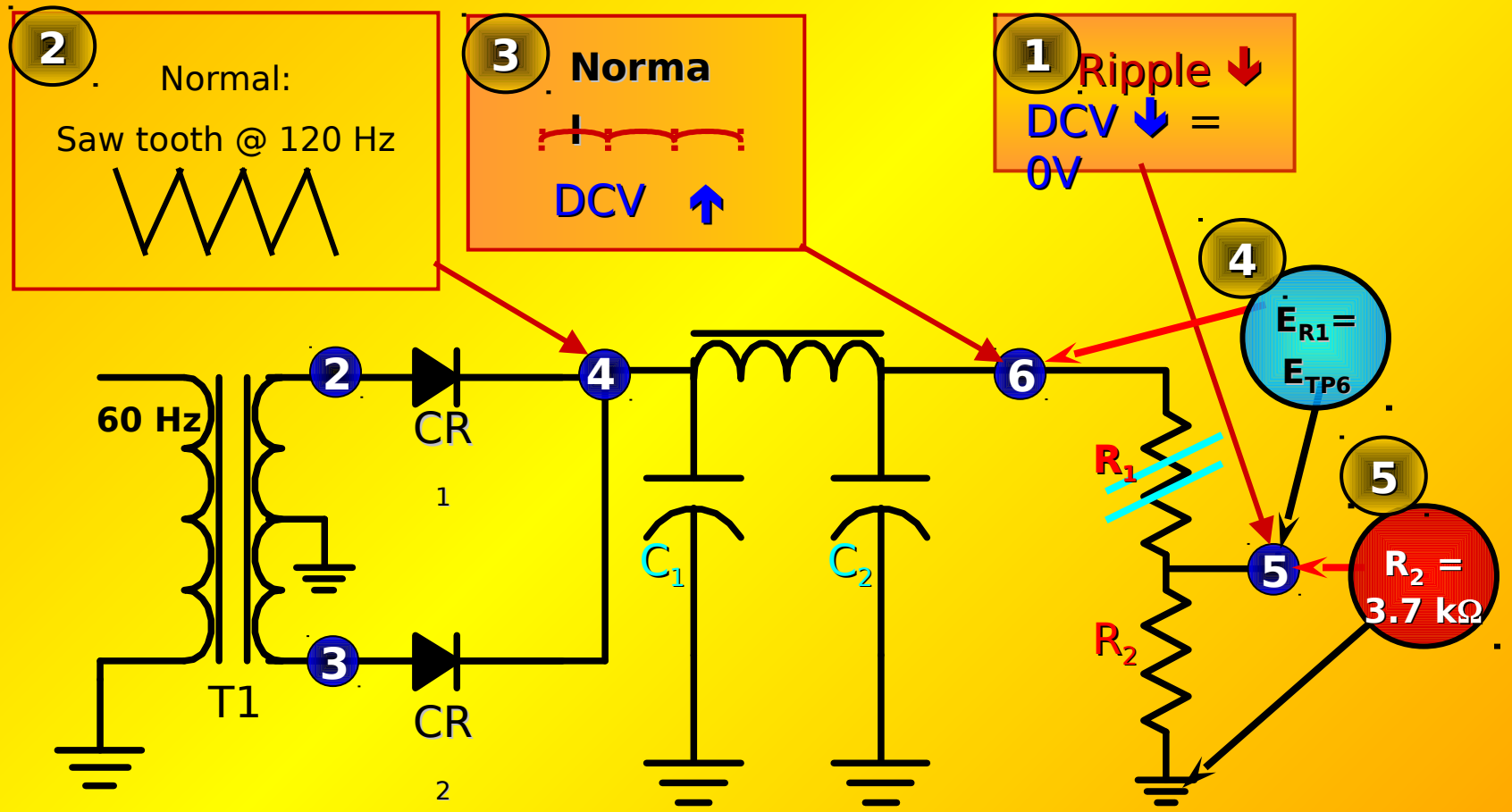
½ Split Method : DC Voltage divider Analysis, R_1 SHORT .



R1 Open Analysis

AC: Power Supplies; PC-82

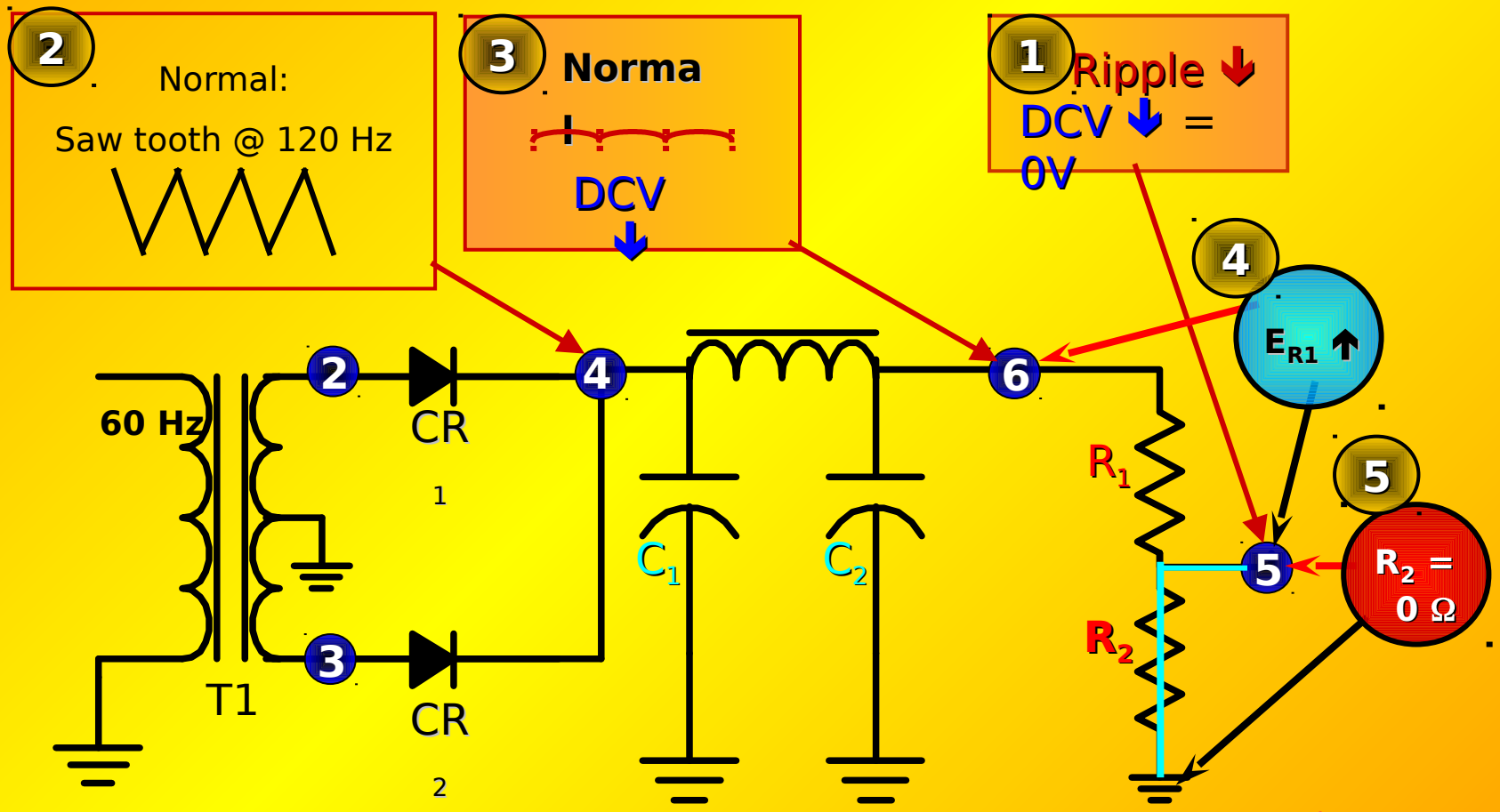
½ Split Method : DC Voltage divider Analysis, R_1 OPEN .



R2 Analysis

AC: Power Supplies; PC-82

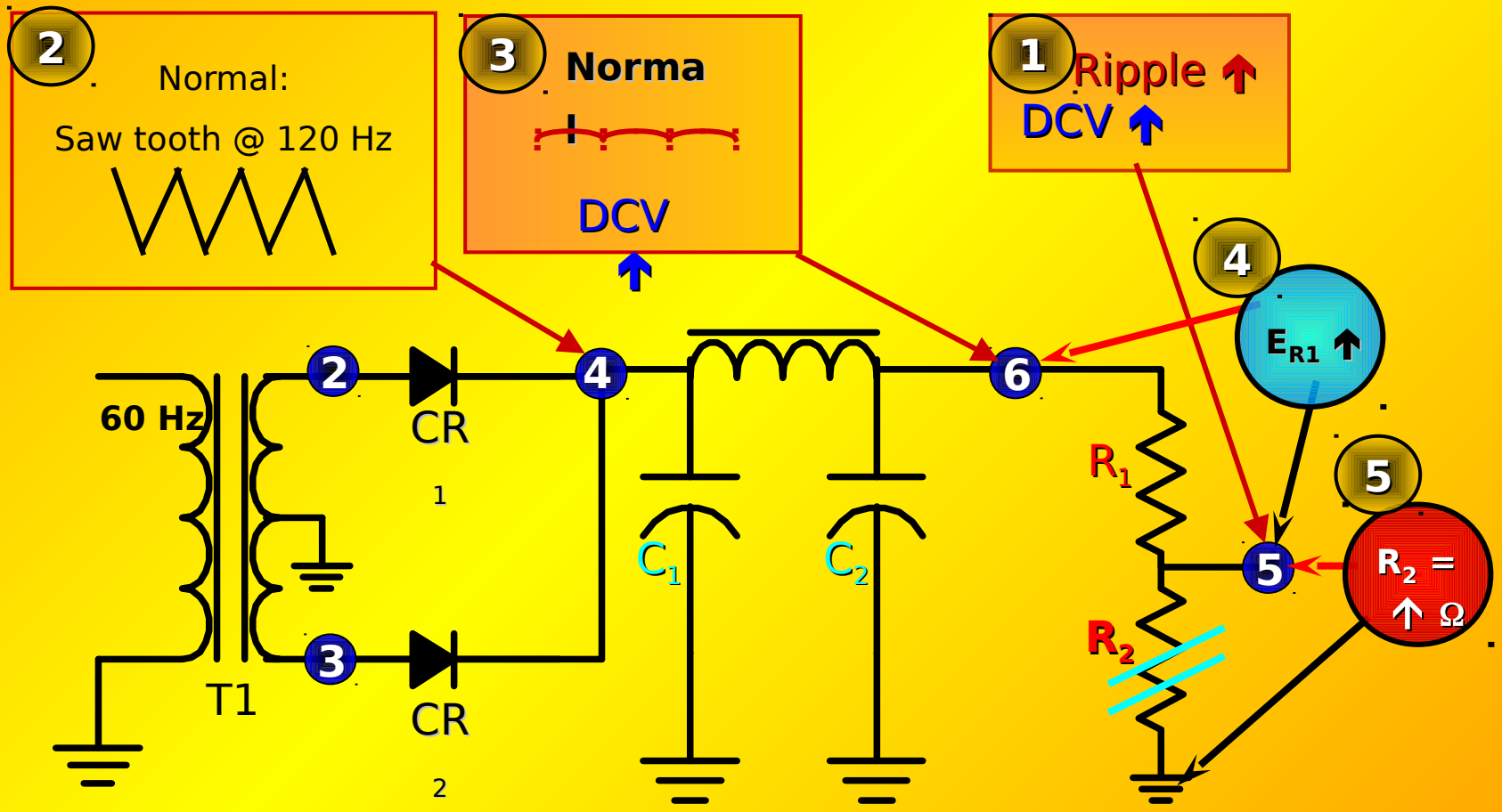
½ Split Method : DC Voltage divider Analysis, R_2 SHORT .



R2 Open Analysis

AC: Power Supplies; PC-82

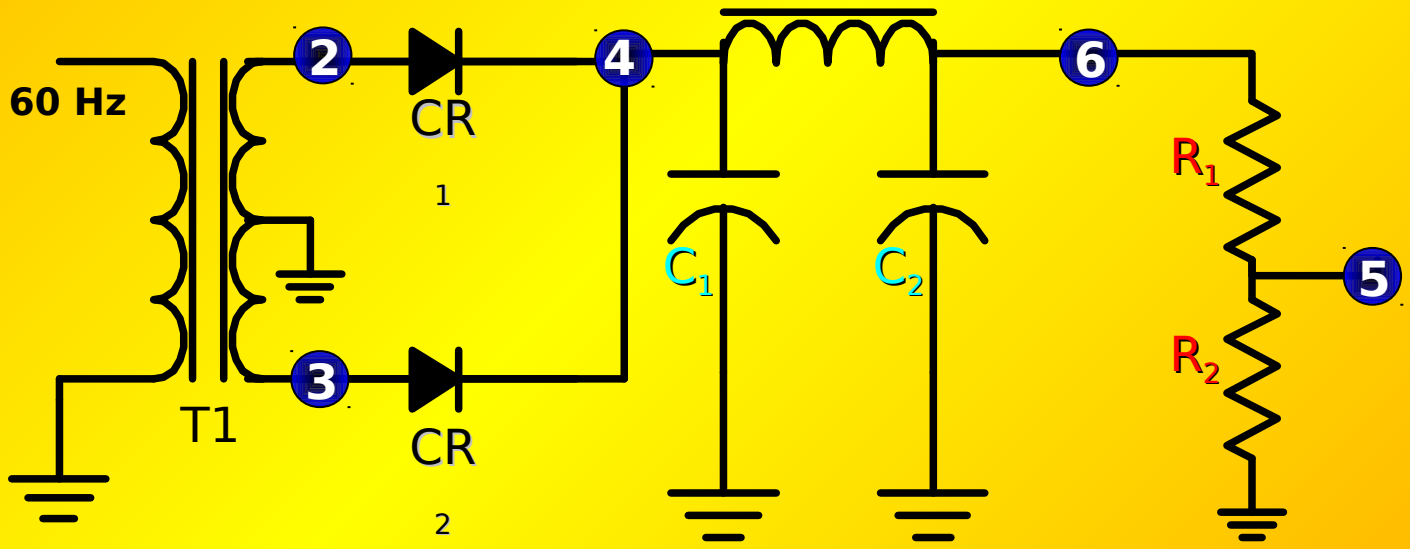
½ Split Method : DC Voltage divider Analysis, R_2 OPEN .



Blank 82 Card

AC: Power Supplies; PC-82

½ Split Method :



AC: Power Supplies;

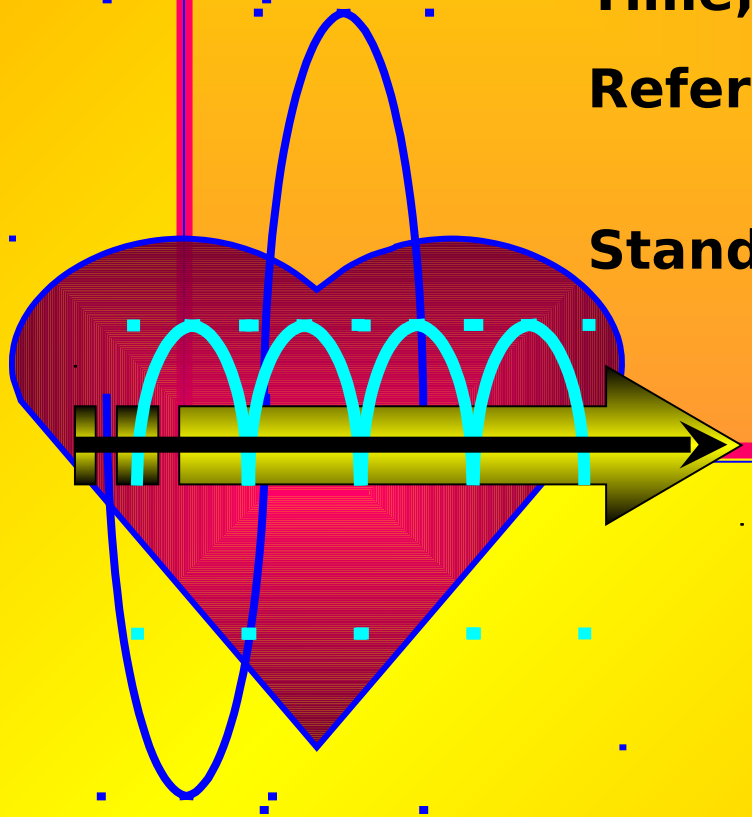
SUMMARY & QUESTIONS:

LESSON TEST:

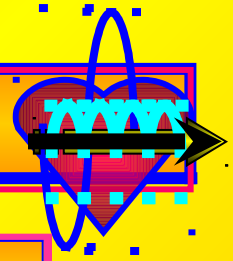
Time; **20 Minutes.**

References; **Official OMEMS Training Aids.**

Standard; **7 of 10 questions correct.**



AC: Power Supplies;



PE Setup:

1. PC 82 card on Pc 1 position, Set S1 ⇧ .
2. Trainer Pc 1; **AC** Pwr "**ON**" {no DC }
3. Enter Defaults; **F104** & **F114**. **[Must be in the trainer @ all times.]**
4. Get Normals; TP5, **Ripple** & **DCV**
   TP4, **Signal**, Freq & **DCV**
   TP6, **Ripple** & **DCV**
   E_{R1}, **DCV**

Troubleshooting Order

5. T/S Bugs & Record.

E- 104	F- 111
F- 102	F- 108
F- 110	F- 113

Note:

Turn Trainer Pwr "OFF" @ Breaks.

Reset Trainer after Each & Every Bug.

Reenter; F104 & F114 Defaults, then enter new Bug #.

END